VIRGINIA WILDLIFE

JULY 1986 ONE DOLLAR

Paige and I were sitting on the bank of the Rappahannock River early this spring. There was a teenage kid fishing from the bank, shirt off, pants rolled up, smoking a cigarette. He struck up a conversation with us. "You all going fishing?" he asked. Yes, we said—explaining that we were waiting for Paige's husband to return with the boat and some extra lifejackets. "Yep, you know, it's illegal to be in a boat without lifejackets for everyone," the young man cautioned." "You can get a ticket that way." We agreed and the conversation trailed off. "Been catching anything?" I asked. "Nah, not much," he said, pulling his line in. The kid flicked his cigarette butt into the water. "A few snakes, that's about all."

I watched the cigarette float down the muddy river. I wanted to say something to him that would make him change his mind about throwing trash into the river. But I didn't want to make him mad, because I knew then that he wouldn't listen. I got stuck on the right words. So I shut up—mad at myself. The kid just kept on fishing and chattering away.

Last week I was standing on Reddish Knob. You know, that overlook where the old fire tower used to be, where you get a 360 degree view of Virginia and West Virginia. It was a rainy Saturday evening, and the mists were rolling through the lichen-covered spruces. The Massanutten Mountains were hidden from view. I walked along the edge of the asphalt, tripped on a nonreturnable Coke bottle, and stepped over an empty, wet potato chip bag. I just stood there—mad again.

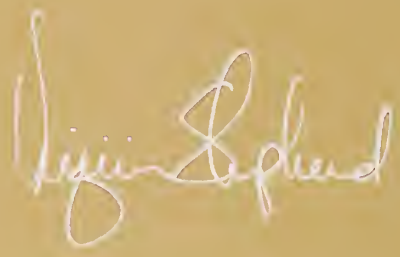
It's hard for me to understand what prompts people to leave their wastes behind, and it's too easy to write them off as the kind of folks I wouldn't shake hands with in public. Because it just ain't true. That kid on the bank was a little rough around the edges, but he wasn't rude or ill-mannered. And those guys that littered on top of Reddish Knob probably would have helped us out of a jam if our truck had broken down, or we'd gotten stuck in the mud somewhere.

The thing is, I *expect* to see litter in movie theater parking lots or in narrow back alleys downtown. But I don't expect to see trash lifted up by the wind on top of a mist-covered mountain or jammed up against a slick boulder sticking up out of a river. I want to know why. And, I guess that's what keeps me tongue-tied when I see someone litter in those consecrated places I call woods. I can't understand *why* they do it, so I can't find the right words to reprimand the indecency, the indignity of it.

I suppose that kind of behavior is even more puzzling because the true hunter or fisherman seeks to leave no trace of his passing. His ability to remain unseen, unnoticed, and invisible in the woods is the sign of his greatness as a hunter. He must surprise his prey. Thus, those who leave behind the careless signs of themselves while carrying the guns, the fishing rods, the bows or the traps with them, to me, are simply imposters. They may carry the outward signs of a life in the woods, but they are empty of the inner ones.

So they thoughtlessly keep on trashing places like Chickahominy Wildlife Management Area in the fall, and our trout streams in the spring, because they are not hunters. And people like me, torn up inside about it, just keep our mouths shut 'cause we keep stumbling over the right words. It's awful hard to deal with deception. Still, that's no excuse.

I should have told the young man so.



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July Issue

Volume 46, Number 7

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Baskers and Bottom-walkers

Virginia's ponds are living, growing and dying grounds for the painted, snapping, stinkpot, spotted . . . and eight more turtles in Virginia.

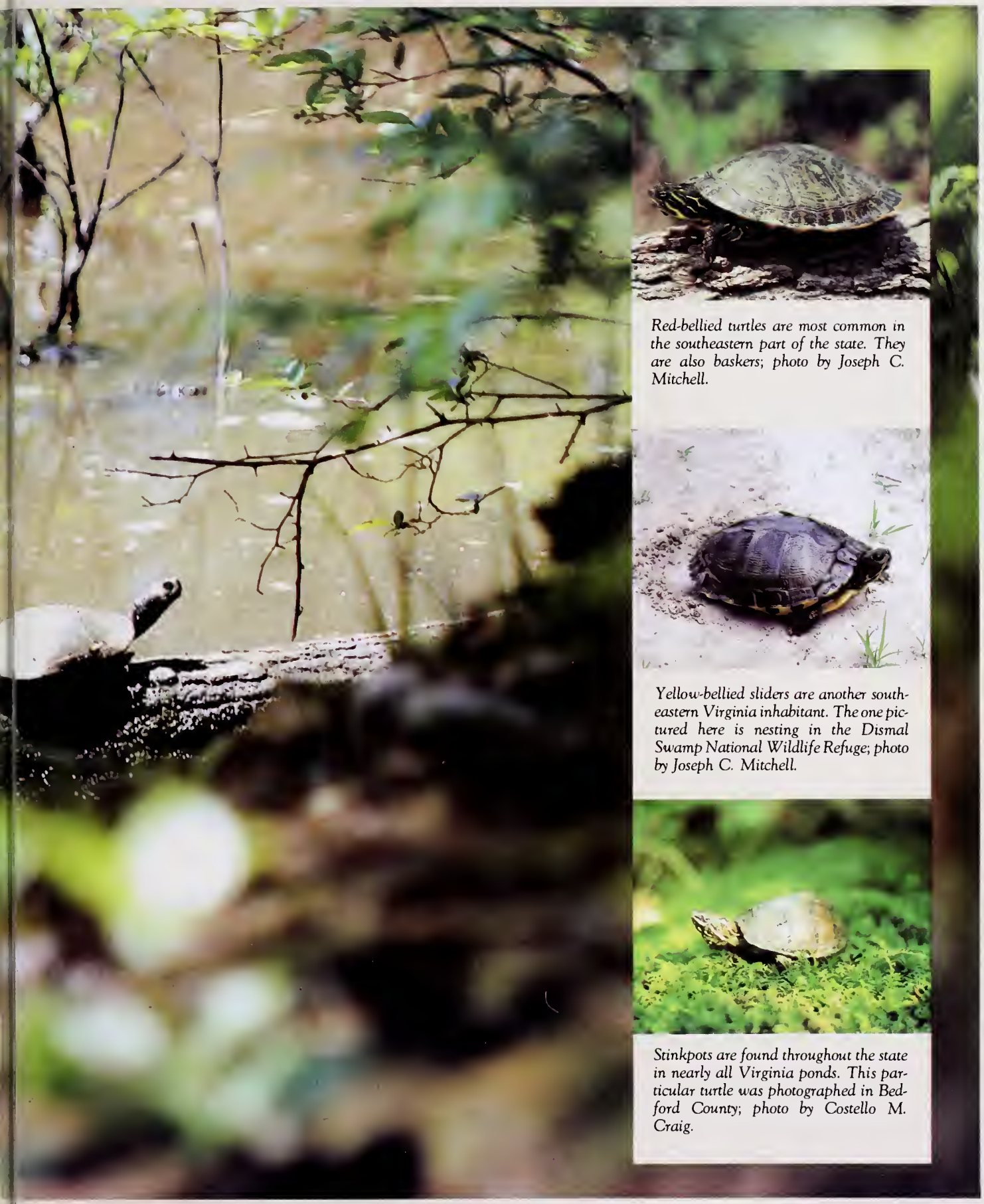
by Joseph C. Mitchell

Ponds. Mention this word, and most of you probably think of fishing, of leisurely sitting on a bank watching the cork bob up and down with the riffles. To me, however, the word pond makes me think of turtles, snakes and frogs; usually in that order, and Virginia ponds are home to an impressive variety of these animals. Though turtles, in particular, may be abundant in ponds, most people see only a fraction of them while fishing or boating.

Three of the 12 aquatic turtles occuring in Virginia, painted turtles *(Chrysemys picta)*, snapping turtles *(Chelydra serpentina)* and stinkpots *(Sternotherus odoratus)*, can be found in almost all our ponds. They can tolerate a wide range of environmental conditions and all three are distributed statewide. In addition, the turtle we all bought as kids at the pet store in the 50's and 60's, the red-eared slider *(Pseudemys scripta elegans)*, has been released in almost every pond and lake in Virginia, and is well-established throughout the state.

In the Piedmont region, mud turtles *(Kinsoternon subrubrum)*, spotted turtles

Painted turtles are the baskers we most often see taking in the sun on logs and rocks in our ponds; photo by Joseph C. Mitchell.



Red-bellied turtles are most common in the southeastern part of the state. They are also baskers; photo by Joseph C. Mitchell.

Yellow-bellied sliders are another southeastern Virginia inhabitant. The one pictured here is nesting in the Dismal Swamp National Wildlife Refuge; photo by Joseph C. Mitchell.

Stinkpots are found throughout the state in nearly all Virginia ponds. This particular turtle was photographed in Bedford County; photo by Costello M. Craig.

(Clemmys guttata) and river cooters *(Pseudemys concinna)* also find ponds inhabitable, though river cooters prefer large lakes and rivers. In the southwestern corner of the state, the map turtle *(Graptemys geographica)*, stripe-necked musk turtle *(Sternotherus minor)* and spiny softshell *(Trionyx spiniferus)* prefer rivers, though the spiny softshell has been recorded in a quarry pond.

The most diverse turtle communities are found in southeastern Virginia. In addition to the three turtles found statewide, a pond in Virginia Beach, for example, may contain populations of spotted turtles, mud turtles, red-bellied turtles *(Pseudemys rubriventris)*, yellow-bellied sliders *(Pseudemys scripta)*, and chicken turtles *(Deirochelys reticularia)*.

Most readers have seen turtles basking on logs and rocks in our ponds. The most common one statewide is the painted turtle. Scientists categorize it and the larger slider, cooter and red-bellied turtles into a group called *basking turtles*—because they do that a lot.

Stinkpots, mud turtles and snappers are *bottom-walkers*. These turtles aren't often seen since they bask only rarely. Virginia ponds are comprised of one or more basking species and one or more bottom-walkers.

My doctoral and present research with the Game Commission's Nongame Program has shown me that there are *lots* of turtles in Virginia's ponds. You just don't see most of them. I studied one urban turtle community in Henrico County for several years by mark-recapture. I assigned every animal a unique number by filing notches in its shell. Capturing these turtles many times over a long period of time allowed me to estimate the number of individuals of each species in the pond.

For one particular year of the study,

Above: Though the spiny softshell turtle prefers a river habitat, it has been discovered living in a quarry pond in the southwestern corner of the state; photo by C. W. Schwartz.
Left: The snapping turtle, one of our bottom-walkers, is found throughout the state in nearly all our ponds; photo by C. W. Schwartz.

there were 517 painted turtles and 534 stinkpots estimated to have been in the 10-acre pond. Over the course of three years, I marked 818 painted turtles, 636 stinkpots, 110 snapping turtles, 90 red-bellied turtles, 12 mud turtles and 2 spotted turtles. And I know I didn't capture all of them!

Not only are there a lot of turtles in a pond, but the amount of energy or biomass stored in turtle meat and bones in that particular pond turned out to be about 75 pounds per acre. Game Commission fish biologist Dan Shuber tells me that 240 pounds per acre is a ballpark estimate for the amount of fish biomass in an average pond. Thus, it's obvious that turtles and fish are major components of a pond ecosystem.

Turtles, like other animals, don't just convert the energy from the food they eat into healthy meat and bones. Some of that energy is partitioned off into babies, as I like to say. Energy is used for courtship and mating, the production of eggs and sperm, and the arduous task of nest construction and egg-laying.

Like many reptiles, larger turtles usually produce more eggs than smaller turtles. Small painted turtles, for instance, lay one to four eggs in a single clutch, whereas large ones can lay up to seven. Small snapping turtles, on the other hand, are known to lay as few as 10 and large ones as many as 55 eggs. Although snappers lay only one clutch per year, most of the other Virginia species can lay up to two clutches in a single season, about 2-3 weeks apart. Egg-laying occurs from late-April to mid-July, depending on the species and location in the state.

Hatchling turtles are small and vulnerable to predation from many predators. Turtle size at hatching ranges from about ¾-inch in shell length for stinkpots to about 1½-inches for snapping turtles. Thus, hatchlings avoid predation by hiding in grasses and overhanging vegetation along the pond's edge. This helps decrease their visibility to large and smallmouth bass, other fish, and snapping turtles.

Baby turtles are also eaten by cottonmouths and bullfrogs. Those turtles which have to bask, like painted turtles and red-bellied turtles, risk predation by green herons and great blue herons. And, young boys and girls are often predators of small turtles when they capture them for pets—because they are removing animals from a population.

Adult turtles are more protected because of their harder shells, but a few predators, like bald eagles and some hawks, can get around that. The most important predator, however, is the raccoon, which digs turtles out of the mud in shallow water at night. Raccoons will eat a turtle's rear legs off first, then scoop its insides out with their long foreclaws. Egg-laying females, often nesting at night, are particularly vulnerable. Raccoons eat a lot of painted turtles, but will eat other species, including snappers, when they can dig them out of the mud during low water periods. Ranger Rick may be a nice guy, but his cousins are voracious predators in the real world.

Even though predators take their toll, once turtles reach adulthood, the chance of surviving from one year to the next is pretty good. We all have heard of box turtles with dates carved into the shell aging them at nearly 100 years old. But, pond turtles are also long-lived animals. Research being conducted in several places in North America is showing that basking and bottom-walking turtles often live 30-50 years and longer. Females of the larger of these turtles do not even reach maturity until they are seven to eight

"One aspect never explored is the competition for nutrients by the fish and turtle communities."

years old. Males usually mature two to three years earlier. It never ceases to amaze me that some of the animals I work with are older than I am.

The age at which a turtle matures is partly dependent on growth rates during its first few years of life and the amount of growth per year in juveniles differs between ponds. Painted turtle females may mature in one pond at age six, and in another pond only a few miles away at age eight. Painted turtles in a population near the Atlantic Ocean grow much faster and reach larger sizes than painted turtles in a population near Richmond. This phenomenon also occurs in other species of turtles.

Why the differences? The answer must lie in the nutrient content of the food they eat including insects, snails, plants, and carrion. A pond system has its own particular amount of energy or nutrients at any given time. That amount available for turtle growth would certainly differ between ponds for lots of reasons, including the type of land use around the pond and quality of water.

One aspect that has never been explored is the competition for nutrients by the fish and turtle communities. The large population sizes of both fish and turtles, and the fact that body sizes and growth rates differ between ponds for both of them, suggest one group may have some effect on the other. They both eat much the same food types. I have heard that some people think turtles divert nutrients away from fish, especially game fish, so that the fish grow slower and may not get as large as they would if there were no turtles. Does this really happen and, if so, how important is it? It's an important question with no known answers.

Most people like or simply ignore turtles and don't normally kill them as they do snakes. Some turtles are killed once they're hooked on fishing lines, but except for draining or filling in of wetlands (like around the Chickahominy River swamps) and snappers taken for food, most turtle populations in ponds do not appear to be seriously affected by man and his doings.

Both professional and amateur turtle hunters do take large numbers of snappers during the warm months of the year, though. There is no season or bag limit in Virginia, so trappers often take the egg-laying females and the population may not recover for many years. The data I have on size of snappers suggest that Virginia snappers are smaller than those found farther north. While northern snappers may be bigger than southern ones for biological reasons, an equally valid cause may be that over-collecting has occured here. Our turtles may not have the time to get as big as they used to be.

A recent study in Michigan showed that over 300,000 pounds of snappers are harvested annually by amateur sportsmen, and the researchers did not know how much the professional trappers harvested. I personally believe that snappers can provide a harvestable resource; however, there are many questions to be answered before we can determine whether current harvest practices are threatening the future of this resource in Virginia.

No one knows much about turtle ecology, especially when it comes to the interaction of turtles with other species in their environment, such as fish, birds and invertebrates.

There's a lot left to be learned. □

Joseph C. Mitchell is the principal researcher on a statewide reptile and amphibian survey funded by the Game Commission's Nongame Program.

Editor's note: See the June, 1976 issue of Virginia Wildlife *for a helpful article on turtle identification.*

Superstar Sunfish

Fishing for redbreast sunfish is guaranteed to turn even the most discouraged angler into a star.

by Bruce Ingram

Some things in fishing will never be. I'll never catch the world record largemouth. Homer Circle will never ask me for bassing advice. And no network will ever pay me to host a fishing show.

But there is a fish in Virginia that can turn you and me into angling superstars. The main purpose of the redbreast sunfish I believe, is to transform frustrated fishermen into All-Star anglers.

I first witnessed the redbreast's ability to turn bad outings into good ones

illustrations by Carl "Spike" Knuth

Sunny Fishin'

by Carl "Spike" Knuth

Sunfish were made for ponds—or was it the other way around? One thing is sure, sunfish and ponds go together like pizza sauce and mozzarella cheese! It's a rare pond that doesn't have some member of the sunfish family in its waters. The sunfish family consists of some 30 species native only to North America and ranging in size from the one-inch pygmy sunfish to the over 20-pound largemouth bass.

Sunfish of all kinds are plentiful, ready biters and seldom disappoint the angler. There are three main species of sunfish that are of special interest to pond anglers. The common sunfish, or pumpkinseed; the bluegill, or bream (brim); and the redear or shellcracker.

The common sunfish is the namesake for the whole tribe. In addition to pumpkinseed, it is also known as sunny, sun bass and pond perch. It's a fish that truly does seem to love the sun. It inhabits shallow, sun-drenched waters that other fish avoid. It's at home in slow-flowing brooks, small lakes and ponds. Even in the heat of summer at mid-day, it's one fish that an angler is sure to catch in weedy, clear shallows, if you fish your bait a little slower than you would for bluegills. Sunfish usually study or investigate a lure or bait as they approach it. However, it they think one of their companions is going to beat them to the dinner table, they may rush right in and grab.

To fish for pumpkinseeds, use the lightest tackle you have. Use a small bobber, a number 10 or 8 hook, a single split shot and cast your worm or cricket to gravel beds near shore or clearings in weed beds. Pumpkinseeds tend to go for smaller lures or tidbits of worms.

when I was about five years old. After spending weeks trying to convince my father that I was old enough to go fishing, he at last agreed on a trip to the Roanoke River. Once there, I dunked garden worms below an oversized red-and-white bobber for what seemed like hours. Just when my patience was almost exhausted, I finally caught my first fish—a sunfish.

I was so proud of my prize that I hauled it home in a Mason jar filled with water. For several days, I paraded the fish around our neighborhood. I remember thinking that I was no longer just a little boy. Magically, that sunny had transformed me into an outdoorsman in the grand tradition of Daniel Boone and Davy Crockett.

Redbreast sunfish also added a certain richness to my early teen years. A friend and I used to pedal our bikes to Masons Creek in Roanoke County. Upon arriving, we would take an old window screen and seine for minnows.

After corralling a number of shiners and creek chubs, we would spend a pleasant summer afternoon fishing for redbreasts. More often than not, we succeeded in landing enough for dinner.

The whole ritual was an important part of changing from a boy to a man. Proving to our parents that we could travel to the creek and back without wrecking our bikes or becoming lost was important to our budding self-reliance. Catching our own bait and supplying our families with food added to our self-esteem.

It would be a mistake to assume that sunfish only save the day for young boys or girls. Last June, I went flyfishing for brown trout on Smith Creek in Alleghany County. A portion of the stream is restricted to single hook artificial lures and that was the stretch where I decided to put my flyrodding skills to the test. In short, those skills were found to be sadly lacking.

Not long after I arrived on the creek, a series of hatches began. The browns began feeding wildly—at times literally jumping from the water in their frenzy. For two hours I tossed everything: drys, nymphs, streamers, crayfish, even leech imitations. All failed to fool even one trout. In fact, I only had one rise—

although the browns foraged furiously all during that period. Finally, on a back cast I left most of my leader in a tree, thus mercifully ending all trout angling for the day.

As I was preparing to leave in total humiliation, I saw a school of sunfish in a quiet pool. I tied on a nondescript 25-cent popper with yellow spider-like legs. During the next 45 minutes, I seemingly battled every sunny in that hole at least twice. The sunnies may not have been feeding on a hatch of golden legged spiders, but at the time no one could have convinced me otherwise. I went home refreshed—my belief in my angling prowess restored.

Strange looking poppers aside, there are very few lures which redbreast sunfish won't hit. Proven winners include Mepps Aglias with size 1 silver or gold blades, 1/16 ounce white or yellow jigs, inch-long Rebels or Rapalas, and a wide variety of small spoons, plugs, crankbaits, and minnow imitating artificials.

While flyfishing, try imitation hellgrammites, crickets, beetles, sculpins, and crayfish. Generally, though, sunfish will attack any fly that they can get their tiny mouths around—and some that they can't.

My favorite lure for red bellies is Cordell's Big O in a crayfish pattern. I can twitch this creation across the water for surface action and also bring it by submerged boulders and trees when fish are holding deep. Or I can employ a stop-and-go retrieve for those *Lepomis auritus* which are a little hesitant to strike. Sunnies will often attack the Big O when the retrieve has stopped and the fake craw is slowly rising to the surface.

Perhaps the single best place to prospect for sunfish is an eddy. Almost every eddy in most clean flowing creeks and rivers can be counted on to cough up fish. Other stream hot spots include pools formed by waterfalls, current breaks behind rocks, and undercut banks with shoreline cover.

Basically, redbreasts prefer holding areas near moderately swift water. Some of my biggest ones, however, have been caught along weedbeds, near lily pads, and in elodea choked sections of waterways.

Bluegill

The bluegill is probably the best known and most plentiful of our sunfish. Easily recognized by its large, black opercular flap, it is pound for pound one of the scrappiest of all fish. Bluegills are common in just about any kind of water with stable levels and they are prolific breeders. They can overpopulate a pond quickly if not kept in check by heavy fishing.

Look for bluegill nests in May, although they'll spawn into the summer in some cases. They aggressively attack anything that gets close to their nest, hitting at it in defense more than out of hunger. Bluegills will take a variety of artificials such as poppers, nymphs, spiders and flies, and can be caught on light tackle, #6 or #8 hook with a single small split shot and small bobber. When using crickets, use a long-shanked hook. Fish the crickets or worms up close, or even under overhanging brush. If you know of holes, dropoffs or deep points in the pond, fish them during the hotter part of the day. The summer sun may force bigger bluegills into cooler, deeper water, but they'll come back inshore during the morning and evening hours. The heavily brushed shores with overhanging trees and shrubs may hold bluegills all day in the cool, shaded water under the branches.

The redear sunfish gets its name from the bright red borders on the black opercular flaps of the male fish—reddish-orange on the female—during spawning. The redear is native to the cleaner, clearer, quiet waters of the southeastern states. Redears are excellent for small ponds because their reproduction rate is slower than bluegills, yet their growth rate is faster than other sunfish species. They spawn only in spring, not into the summer like bluegills. Because of this they don't overpopulate a pond and regularly reach nine to 14 inches in length.

Redear

The redear also fills an ecological niche by not competing with bluegills for food. Redears feed on bottom organisms such as mollusks, small crayfish and insect nymphs. They have a special liking for snails and you will occasionally see them feeding off of the bottom with tails up. They have molar-like teeth used for cracking and crushing shells, hence its other common name "shellcracker."

Redears are more wary than bluegills and harder to catch. Actually, other than when they are on the spawning beds, redears are generally hard to find and catch. To catch redears, fish on the bottom. A gob of redworms or small nightcrawlers cast near shore under overhanging vegetation, or inside weed beds or along or amid water lily beds is one way to catch redears. Allow the bait to lay on the bottom, writhing and squirming to attract a redear. If you don't get a hit, pick up and cast again. Redears will not move too far to take a bait, and they tend to nibble rather than hit and run. If you fish with a bobber, set the depth a few inches deeper than bottom, allowing the bait to lay on the bottom. Few redear are caught outside of the spawning season unless they can be found. One possibility is to fish deep with live bait or jigs near the deep sides of weed beds. Try fishing the little lead head rubber jigs from a beetle spin without the spinner. You may be surprised. One trait the whole family exhibits is that of fanning out some sort of nest—usually saucer-shaped—and spawning in the shallows. Knowing when and where to look for these spawning beds can lead a pond angler to some very productive fishing.

If you have access to a small lake or pond, visit it often through the season. Learn its waters, its weed beds, drop-offs, gravel beds, brush piles, stumps, and logs. Observe and record what you see and when you see it. Learn the individual species and their habits. You'll find that one of the more satisfying activities in the outdoors is fishing pond sunfish.

Spike Knuth is TV and motion picture producer for the Commission and also a familiar name to Virginia Wildlife *readers.*

Dr. Robert E. Jenkins and Noel M. Burkhead in their upcoming book *Freshwater Fishes of Virginia* funded by the Game Commission's Nongame Program, describe the redbreast males as being "a splendid mix of red, orange, yellow, and various shades of blue, whose iridescence is difficult to capture on film." The male typically boasts a deep red-orange breast and abdomen while the female's is usually a bright orange-yellow. Both have long, entirely dark earflaps and large eyes.

The two biologists have observed these sunfish guarding nests from very late May through mid-July. As is typical for this family of fish, it is the male which builds the nest in lightly silted sand and gravel.

Jenkins and Burkhead further note that nests are typically found along pool margins in water less than a yard deep, though they may sometimes be found behind boulders. Spawning often begins when the water temperature reaches 61°F, when females will deposit between 1,000 and 5,600 eggs.

Redbreasts rarely survive more than eight years in the wild with most fish living between four and five years. Adults usually average between five and 7½ inches in length with individuals over eight inches being real trophies.

I have battled redbreasts in the James, New, Shenandoah, Cowpasture, and Roanoke Rivers and in a number of creeks. Other good streams include the North and South Anna, the Tye, Appomattox, and Rappahannock Rivers. These sunfish are abundant in many areas of the Old Dominion especially from the middle Piedmont westward. They are less frequent in the lower Piedmont and coastal plain and generally avoid swampy and acidic water altogether.

Biology aside, the real word that describes sunnies is *fun*. From late March to early November, they'll be finning about in a stream near you. If you're a budding fisherman or even if you're a veteran outdoorsman, this superstar of a sunfish is guaranteed to turn you into an All-American angler. □

Bruce Ingram is the Virginia editor for Outdoor Life *magazine and a frequent contributor to* Virginia Wildlife.

Farm Pond Management
Weed Control

by John W. Kauffman

Have you ever wondered if the only way to correct your farm pond weed problem may be moose, hippopotamus or manatee? Believe it or not there are more practical solutions to such problems, but you, the owner, must know when to use or not use them!

Aquatic plants are a natural part of the aquatic environment and provide food and cover for fish. They also protect the bank from wave erosion, serve as food and nesting habitat for wildlife, and are often the best fishing areas for the larger fish. Many aquatic plants also produce beautiful flowers or otherwise add to the pond aesthetics.

Plants are considered beneficial until they interfere with an intended use such as fishing, swimming, or boating. Generally, if plants cover more than 25 percent of a lake surface, they create a problem. Extensive beds of vegetation may provide too much escape cover for forage fish and interfere with bass feeding. The reduced predation results in slow bass growth and may lead to an overabundant bluegill population.

For new pond owners, "an ounce of prevention is worth a pound of cure" and two weed control principles apply. First, design the pond so the water around the shoreline will be three to four feet deep. Second, don't introduce aquatic plants into your pond. Today's aquatic plant introduction can become next year's problem weed. Fish cover is important, but can be achieved by introducing artificial cover which is controllable, such as brush reefs (see "Home in the Reef" in the August 1985 issue of *Virginia Wildlife*, for more information).

If it is too late, and you already have a nuisance weed, it's time for you to switch roles and become the "pond doctor." Four steps are necessary to cope with the problem:

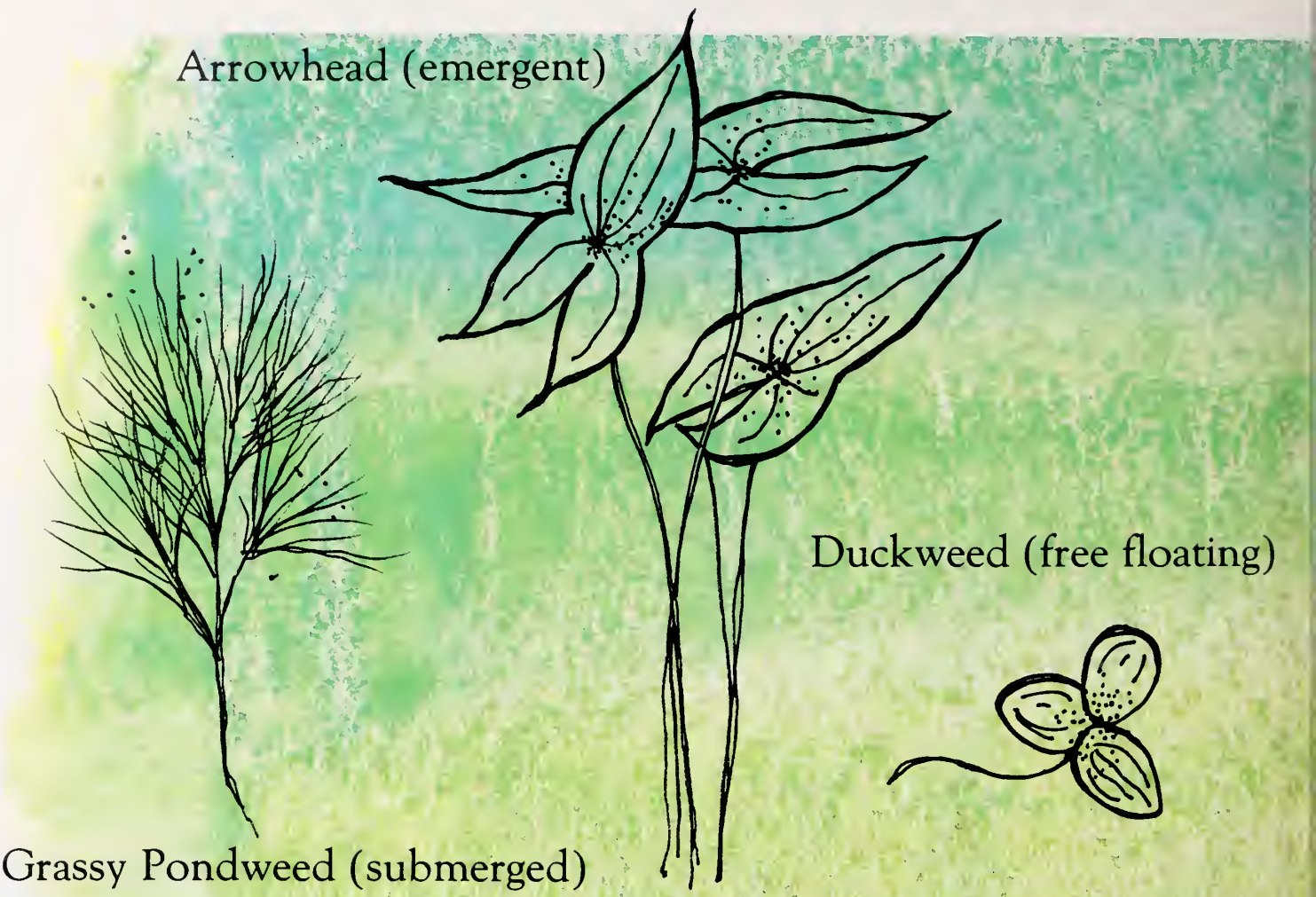
1. *Ask yourself, "What is the history of the pond?"* Is the pond too shallow? Can you identify a source of excessive nutrients such as a barnyard feedlot, intensively fertilized watershed, or leaking septic tank? If such problems exist and can be corrected, do so!

2. *List your ponds uses.* Irrigation, water supply, and livestock watering uses will severely restrict the vegetation control methods you can use.

3. *Identify the problem plant.* Many of the treatments or control measures are quite specific, and therefore depend on proper plant identification. There are four broad categories of problem plants:

Filamentous algae: This algae consists of cells in long stringy, hairlike strands. It is frequently called pond scum. Another advanced form of algae, *chara*, looks like a rooted plant with its whorls of ribbon-like stems.

Floating plants: These plants have true roots and leaves, but are not



anchored in soil. Instead, they float on the water surface. Examples are: water chestnut and water hyacinth.

Submerged plants: These plants are rooted to the bottom and have most of their leaves beneath the water surface. Some have floating leaves, but the plants are still attached to the pond bottom. Some examples are: elodea, hydrilla, coontail and naiad.

Emergent plants: These are rooted plants which produce a majority of their leaves above the water surface. Common examples are: cattails, water lily, and arrowhead.

4. *Choose the proper control method.*

Control Methods

Your choices of weed control include biological, mechanical, and chemical means. Each method has its advantages and disadvantages depending upon the plant species, pond condition and uses, and landowner preferences and objectives.

Biological Control is the fastest advancing field in pond management. Although various species of fishes, crayfish, insects, and plant diseases have been evaluated, most with disappointing results, the bright spot in biological control is production of a sterile grass carp. Also called the white amur, the grass carp has been successful in controlling many submergent weeds, though most states have prohibited importing the fish due to its unknown long term effects on native fish populations. However, recent scientific advances have resulted in a sterile fish which removes any long term problem.

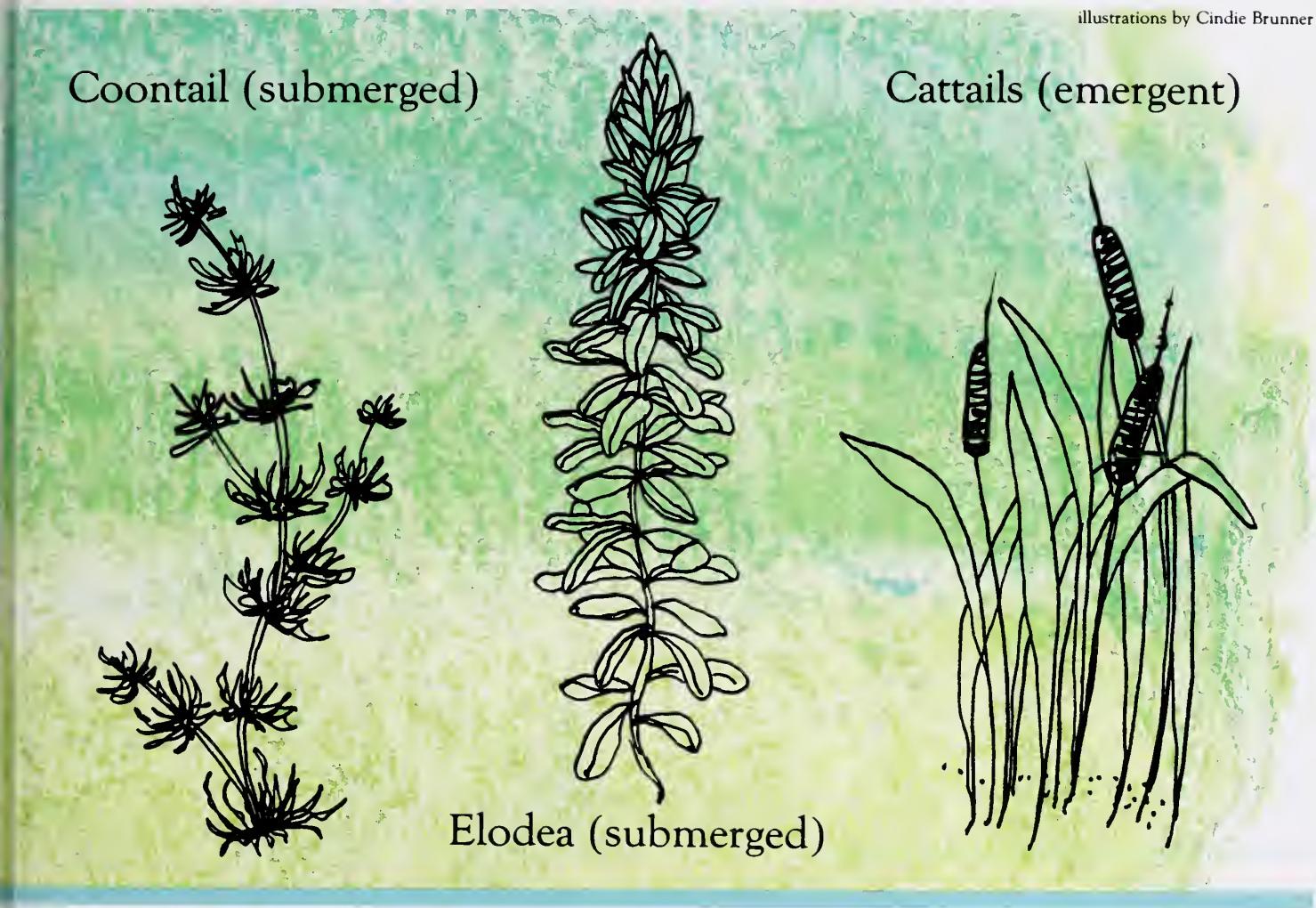
Sterile white amur have been experimentally stocked in three Game Commission lakes. They have effectively controlled the weeds at two of the lakes. Weed control is expected to last for three to five years before the sterile grass carp dies. Additional fish need to be restocked if the weed returns. Grass carp will control many floating and submerged plants, but do not effectively control filamentous algae or emergent plants such as cattails or water lilies. Biological control with the sterile grass carp is the preferred method of weed control if there is a choice. And it is more economical for the pond owner than other methods.

However, a permit must be obtained from the Game Commission prior to purchasing and importing the sterile grass carp.

Israeli carp is another fish that is sometimes sold for weed control, but is not recommended because it controls vegetation by muddying the water. Thus, using Israeli carp would make your pond unsuitable for fishing and swimming.

Several methods of *mechanical control* exist, but all require a great deal of work, and need to be repeated over time. For starters, you can reduce shallow starting areas for weeds in your pond by deepening the pond to a depth

illustrations by Cindie Brunner



of three feet or more. You can also resort to pulling, raking or digging to control floating or emergent plants. If this is done before the plants have spread out of control, this method may be successful; however, it may be necessary to repeat the control at weekly intervals. Plus, this method will not work on such plants as elodea and hydrilla, since the cut plant fragments will root and produce more plants.

Chemical Control has been the most widely used type of aquatic plant control. This method is sometimes controversial, but for certain plant groups, such as filamentous algae and emergent plants, it may be the only effective contol method. Chemicals, however, provide only short-term control, since the plant will return if environmental conditions remain unchanged. Filamentous algae is the best example of rapid regrowth, and several treatments a year may be necessary for control.

Chemicals must be used with caution, since they are expensive and improper treatment can have serious consequences. The following steps must be followed before using chemicals in a pond:

1. Positively identify the problem plant.

2. Know which chemical works on the problem weed and identify the area to be treated. (Refer to the article "How to Calculate Your Pond Volume" in the April 1984 issue of *Virginia Wildlife* to determine how much chemical treatment is needed in *your* pond).

3. Read and follow the label directions! One herbicide frequently recommended by retailers has no restriction on swimming or fishing, but the water cannot be used for irrigating or watering livestock for a year.

4. Fish can be killed if large amounts of weeds are dying, because decomposition consumes oxygen. Therefore, no more than 1/3 of a heavily infested pond should be treated at a time.

5. Treat your pond in the spring, when the leaves are new and the plants are growing rapidly.

Remember: weed control requires investigation and good planning. The result of not doing a good job can result in an unnecessary expense or possible damage to your pond.

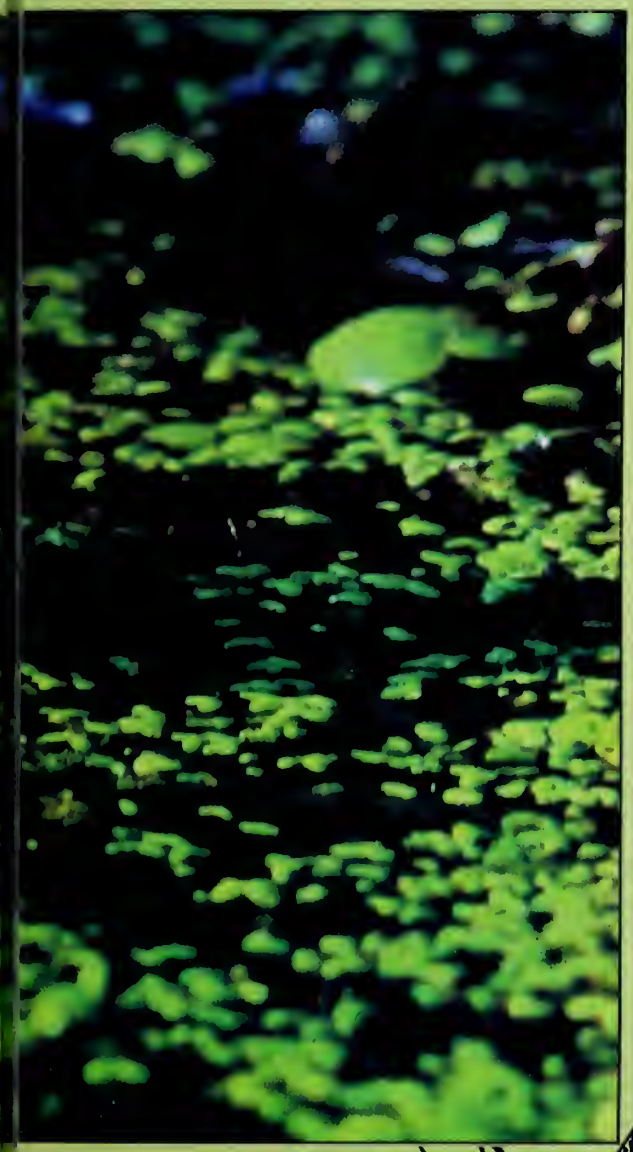
John W. Kauffman is the regional fish division supervisor in the Charlottesville area.

Additional information on weed control and permitting procedures can be obtained from any Fish Division office listed below:
Charlottesville: 804/296-4731
Fredericksburg: 703/899-4169
Marion: 703/783-4860
Mecklenburg: 804/374-2656
Staunton: 703/885-9030
Roanoke: 703/983-7704
Chesapeake: 804/485-1126
Ashland: 804/798-3677
Richmond: 804/257-1000

Bullfrog (Rana catesbiana); *photo by Bill Portlock.*

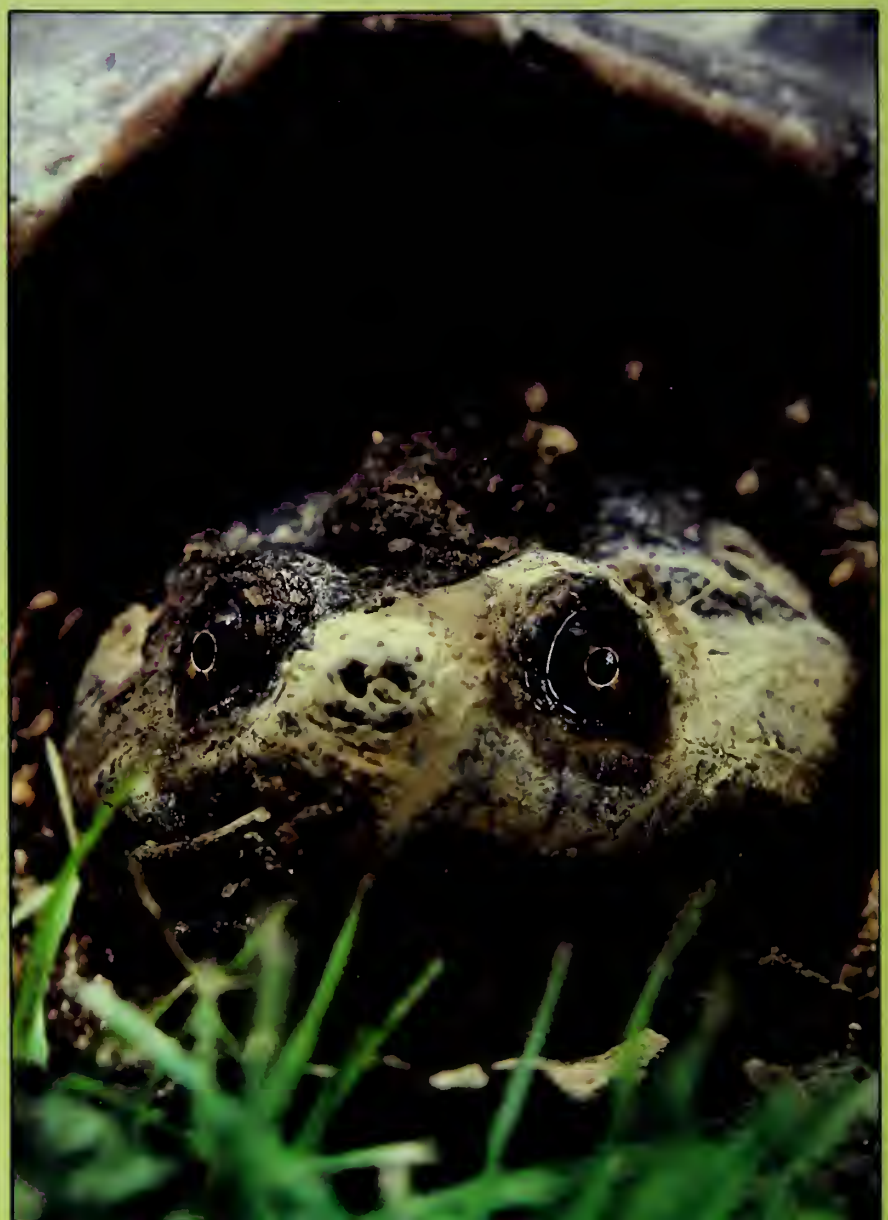
Pond Tenants

A Photographic Essay



Belted kingfisher, (Megaceryle alcyon); *photo by Vinyard Brothers.*

Above: Water lily (Nympyhaea odorata) *at Seashore State Park; photo by Christopher Pague.*
Right: Snapping turtle, (Chelydra serpentina)*; photo by Steve Maslowski.*
Below: Dragonfly; photo by Gregory K. Scott.



Right: American toad, (Bufo americanus); *photo by* C. W. *Schwartz.*
Below: Green-backed heron (Butorides striatus), *photo by Steve Maslowski.*

Above: Dragonfly; photo by Bill Portlock.
Left: Bullfrog, (Rana catesbiana); *photo by C.W. Schwartz.*
Right: Great blue heron, (Ardea herodius);
photo by C.W. Schwartz.

Beavers—
Loved or Dammed?

by Virginia Shepherd

Pulling up into a driveway off the country road in Hanover, Jeff cut off the headlights. It was November, five o'clock in the morning, and we lifted our shotguns off the rack, clicked the truck door closed, pulled on our hip boots, and whistled his chocolate Lab to heel. One hundred yards behind the house was a beaver pond that the tenants didn't even know existed when Jeff asked permission to use their driveway earlier in the season.

Decoy bags on our backs, guns in hand, we made our way into the swamp. I sank in the darkness nearly to the top of my hip boots. We sloshed over to a blown down tree and rigged up a makeshift blind out of camou netting; then waited for the sun to rise.

The sky lightened on the seven heron nests perched on five leafless trees rising 25 feet in the air. A pair of woodies swooped in low from the left 200 yards out. "Get down," whispered Jeff.

That was the fall. In the spring, back on other beaver ponds, spring beauties and spice bush got in the way of walking. Frogs plopping in duckweed-covered water, red-shouldered hawks circling, otter sign in the mud. Even from a helicopter in April while scanning for eagle nests, we flushed great blue herons and deer and turkey from the redbud edges of the tannin-stained ponds below us.

Once completely wiped out in the state, the beaver is now abundant throughout the state. It is steadily creating new habitat and refuge for countless species of wildlife, while causing headaches for humans who have other designs on the land; photo by Karl Maslowski.

What habitat-changers these beavers are with their precise orange-toothed placement of chipped logs and twigs. And we fancied ourselves the only workers of such wonders. We could do the same, but it would cost us thousands.

Indeed, beavers are the original Soil Conservation Service. They excel at trapping topsoil, minimizing flooding, and preventing sediment from reaching larger streams and rivers. "Beaver impoundments," said A.S. Johnson of Auburn University in a paper presented to a group of foresters in 1967, "accomplish the same results as the expensive small watershed programs of the SCS." Some scientists have even theorized that the concentration of silt behind beaver dams produced most of our valley land in the northern half of North America. Beaver dams also keep water tables high in adjacent pasture and farm land, provide irrigation water for fields, and drinking water for thirsty livestock.

Actually, it all boils down to water. Beavers are the water-bringers. With their dams, beavers provide pockets of water which would otherwise be narrow-running streams, or muddy ditches in the summer. And with the water comes the nesting, roosting and rearing cover for waterfowl; good eats for muskrats, otter, mink, fox and raccoon; refuge cover for deer and turkey; and living and feeding quarters for woodpeckers. And we haven't even touched on the red-spotted newts, mud salamanders, southern leopard frogs, painted turtles, red-bellied watersnakes, and any number of other reptiles and amphibians that find the living good in beaver ponds. Or the catfish, chain pickerel, bass, and yes, even *trout* that multiply in beaver-made water holes. Fax Settle, a Game Commission wildlife biologist in eastern Virginia personally believes that beaver ponds have increased the numbers of woodpeckers in the state, particularly the red-headed and pileated populations.

What other animal besides man can have such far-reaching effects on the populations of so many species? Most wildlife biologists give the beaver 90% of the credit for the increase in the wood duck populations in the state. Not only that, but by creating ideal habitat, beavers have provided wood ducks, mallards and black ducks with a means to expand their range, and additional refuge stopovers for migrating waterfowl in the spring and fall.

Admittedly, the fisheries end of beaver ponds can be a bit more controversial. Some will contest that beavers can dam up good trout streams, but Jerry Sims, a Game Commission forester, is quick to point out that some trout populations actually benefit from beaver ponds. In Highland County on a tributary of the Bullpasture River, for example, he knows of a beaver pond that is stocked with trout and is maintaining a healthy population of the fish. And Dr. Pete Bromley, wildlife extension specialist at VPI & SU, still fondly remembers that 19¼-inch brown trout he took on a dry fly on his favorite trout stream—three years after beavers had dammed it up.

But there is no controversy surrounding the habitat that beavers provide for other fish species. Channel cats find good spawning beds in beaver ponds, and according to Game Commission biologist Joe Williams, chain pickerel thrive in these areas until the ponds begin to silt in. Bass, like chain pickerel, prefer beaver ponds in the early years, but redfin pickerel, sunfish, and bullhead catfish, find the grassy beds of the ponds fine habitat for survival.

Beaver work also provides vital pockets of survival for aquatic species during droughts. Settle points out that during the severe drought of the mid-60's, many biologists attribute the survival of some fish in eastern Virginia to beaver ponds. One could even argue that beaver ponds provide corriders of travel for certain aquatic species—allowing them either to expand their range, or to migrate when habitat is lost due to development or drainage. Beaver ponds, then, not only provide pockets of refuge, but can also provide routes to survival.

Unfortunately, not all find it easy to live with the beaver and its gift of water. "We're running ragged in the spring and fall taking care of beaver problems," says John Baker, a Game Commission wildlife biologist in southwest Virginia, "and it's getting worse each year." Biologists all over the state echo his words. "They're a pain," sighs Don Schwab,

What was once a 10-acre pasture in Augusta County is now a 4-5 foot deep beaver pond, complete with wood ducks and herons—and no grazing cattle; photo by Virginia Shepherd.

An adult beaver in Virginia may weigh as much as 60 pounds, and knows no natural predator except man; photo by Virginia Shepherd.

supervising wildlife biologist in Tidewater. Schwab gets about five or six beaver complaints every month. Jerry Blank, Game Commission biologist aide, gets at least that many calls at his Staunton office, calls he can answer only when he's not working on bear research for the agency.

What's the problem? It's the old man-animal-habitat battle, and it started as early as 1943 in the state with beavers. Before that time, we didn't have a beaver "problem" because we simply didn't have any beavers. In 1911, the last known beaver in Virginia was killed in Dinwiddie County. It wasn't until 1932, with the help of the U.S. Forest Service, that the Game Commission reintroduced 10 beaver into the state from Pennsylvania. Six beaver were released on Big Levels Refuge in Augusta County and four were released on Wingfield's Mill Pond in Dinwiddie County. Between 1932 and 1938, 36 beaver were brought into the state and released in Augusta, Dinwiddie, Goochland, Montgomery, Chesterfield, Cumberland, Prince George, and Craig counties. By the end of World War II, beaver had occupied every county in the state.

The simple fact is that man is competing for the use of the same land the beaver has laid claim to. We want the land for farming, pasturing, timbering, landscaping, and living, and we won't tolerate the beaver messing with us.

"I'd like to keep 'em if I didn't need the pasture," says Augusta County dairy farmer Paul Hill to Jerry Blank one day in early May. Hill is looking at 10 acres of prime pasture that's been flooded by beavers. They've stopped up a six-foot culvert, and three times in the past three weeks, Hill has pulled out the dam. Three times the beavers replaced it, transforming a pasture cut by a trickling stream into a beaver lake four to five feet deep. They've got wood ducks nesting and great blue herons now, and they've also got 12-15 head of cattle going hungry. Hill points out that the beavers have been around for five years, but until now have stayed upstream of the culvert, enjoying the fruits of his farming.

Beavers take down trees, strip bark for food, and then use the timber for dam building, lodge construction and repairs; photo by Virginia Shepherd.

"The first year, we had corn growing in a field and the beaver would cut the stalks off," he said. "The next year they'd just hog it down and take only the ears." Blank explained that the "greedy" second year beaver behavior simply reflected the growth of the beavers. "As they grow, they're going to take out more corn," he said. "After all, a four- to five-year old beaver is going to run you between 45 and 50 pounds."

On Hill's farm, the beaver were on the move. A beaver colony normally will consist of two adults that are mated for life, two to four young of the previous year, and two to four kits (young of the year). Each year before the new young are born, last year's litter are driven out to establish colonies of their own. Thus, on Hill's farm, either the youngsters were on the move, or the colony itself was expanding downstream to take advantage of new food sources. And Hill decided he couldn't let them settle in.

But if Hill was having trouble establishing property rights on his 10-acre pasture, Bill Rillee, woodlands manager for Chesapeake Corporation conceded that his company had *lost* property rights to thousands of acres because of beaver. "We've got 373,000 acres of land base in the piedmont and tidewater," says Rillee. "And beavers claim thousands of acres of it every year. We not only lose the original bottom hardwoods to flooding, but it's hard to regenerate those lands since they're in such a wet condition once the beaver leave. By the time the land's dried out enough for regeneration, the beaver are back in there. We've just lost that land."

Bill Messerly, the manager of technical services at Continental Forests Investments, another timber company owning land in the piedmont and tidewater region, echoes Rillee. "I wish they'd just take all those beaver they brought down from Pennsylvania back up there so we can start growing hardwoods again." Both Continental Forests and Chesapeake Corporation have tried every type of control method available on beaver, from trapping to drainage pipes. "But nothing has been effective on a long-term basis," sighs Rillee. "They just keep coming back."

The official Game Commission policy regarding beaver problems is to issue special out-of-season trapping or shooting permits. But that's not as easy as it sounds. First of all, the fur isn't worth anything in the spring, summer or fall, and it's a monetary loss to the trapper. Secondly, it isn't easy to trap all the beaver out of any area, unless you work at it. You can't be sure how many beaver are in a place unless you spend a lot of time trapping—and trapping right.

Jerry Blank stood in the middle of a 400-acre pasture turned duck, beaver and otter marsh in Augusta County in early May and assessed the trapping problem there. "Last year, the landowner called me in here, and I trapped two large adult beavers. I figured that those two were the male and female breeding pair. If the female had dropped kits that year, they probably didn't survive, since I trapped fairly soon after the kits are born. But, the landowner still had beaver in here last fall. Now, I see that I've got two more beaver out there in traps I set last night. Those two could be young from the previous year. If

Live trapping of "nuisance" beavers is possible, but the problem becomes one of finding a suitable place for relocation. More often than not, a relocated beaver merely becomes "somebody else's" problem; photo by Virginia Shepherd.

that's so, that could be the last of the colony—but you never know. I'm going to try to get Mr. Joyce to tear out the dam to see if any beaver rebuild it. Of course, even if I have gotten all the beaver, there's no telling when a new pair will move in and start the trouble all over again."

And there's another problem with trapping "nuisance" beavers. A lot of people don't want them killed. They want them to be "relocated." The problem with that is that there just isn't any place to put them. "Most of the time when you relocate beaver," says Blank, "you're just giving someone else the problem. In eastern Virginia, in particular, it's hard to move a beaver and *not* give someone else the problem."

But, even though relocation doesn't make good horse sense, some people refuse to budge on the issue. More often than not, those standing firm on the idea of relocation are the new suburban homeowners, those people who are moving in escalating numbers to new housing developments out in the "country." These folks don't seem to realize that when they move in, they're forcing the beaver out, and there's no other place for him to go. The beaver is simply one of those costs that goes along with claiming a piece of habitat for your own. Wildlife pays.

There have even been cases when landowners get into disagreements amongst themselves about what to do with the beaver. Some want to trap the animal, some want him relocated, and some want him left alone. Jerry Blank recalls one case in northern Virginia involving a landowner who was losing the prime selling point of his lakefront property to beavers. They were taking down beautiful large red oaks all over the pond. And he was ready to trap. But he wasn't ready for the coalition of lot owners who vehemently protested the trapping. One woman in particular was so adamant against trapping the beaver that she offered to buy the pond outright. Jerry recalls: "She said, 'I'll buy this pond right now if you let the beaver stay in there. What do you want for it?'

"He said, 'Lady, that'll cost you $50,000.' She pulled out her checkbook. She was going to buy the lake just to let the beaver live there."

The landowner backed down on his offer to sell, but finally got his way. The beavers were moved—after they had dropped a tree on his house, crushing one side of his porch.

In these kinds of situations, it's difficult to entice a trapper to come in and take care of the beaver. "Trappers aren't going to go into these residential areas and trap," says Blank. "They don't want that conflict. They don't want somebody coming out and raising cane or stealing their traps."

So, the Game Commission keeps getting phone calls from frustrated people unwilling to share their land with beavers, and yet unable to shoulder the responsibility of what loss of habitat actually means.

Beaver populations can be controlled by trapping. We proved that when we completely wiped them out of the state in 1911. Management by trapping however, is dependent on the fur market, and beaver pelts have not been consistently fetching high prices for the past 10 years. Since beavers are difficult to skin and heavy to carry out from a swamp in waders, it has been more profitable and much less work to trap other furbearers, such as fox, otter, and mink.

People have tried everything from blowing up lodges with dynamite to poison to breaking up dams stick by stick to control beaver populations. But beavers are persistent. As Messerly says, "The little rascals are smart and they win." So far, the most promising control is the use of drainage pipes to lower water levels in beaver flooded areas. A solid PVC pipe is laid under the dam with a perforated pipe attachment extending 15 feet in either direction from the dam. The beaver can't figure out how to dam all those holes in the pipe, and the water level drops. The Game Commission plans to test this latest device at its Elm Hill Management Area this year.

But depending on who you are, and what you need to survive, you may not want to see those beaver ponds dry up anytime soon. In fact, you may want to see more of them. As Sims said: "You just can't say beavers are good or bad. It depends on your perspective." But if you're partial to wildlife habitat, there ain't much question about whose side you're on. □

The ingredients of a high energy system called a saltmarsh.

story & photos by Curtis Badger

Marsh Grass, Water, & Tidal Muck

The saltmarsh is a disguised energy factory. A saltmarsh produces more than six times the organic matter of a wheat field. And while the wheat is cultivated and fertilized, the marsh is fed only by the tides.

But, you say, wheat will make bread to feed hundreds of people. No one eats marsh grass. Cattle don't even graze on it. What's the point of growing ten tons of grass just to have it die in the fall and spend the winter rotting away?

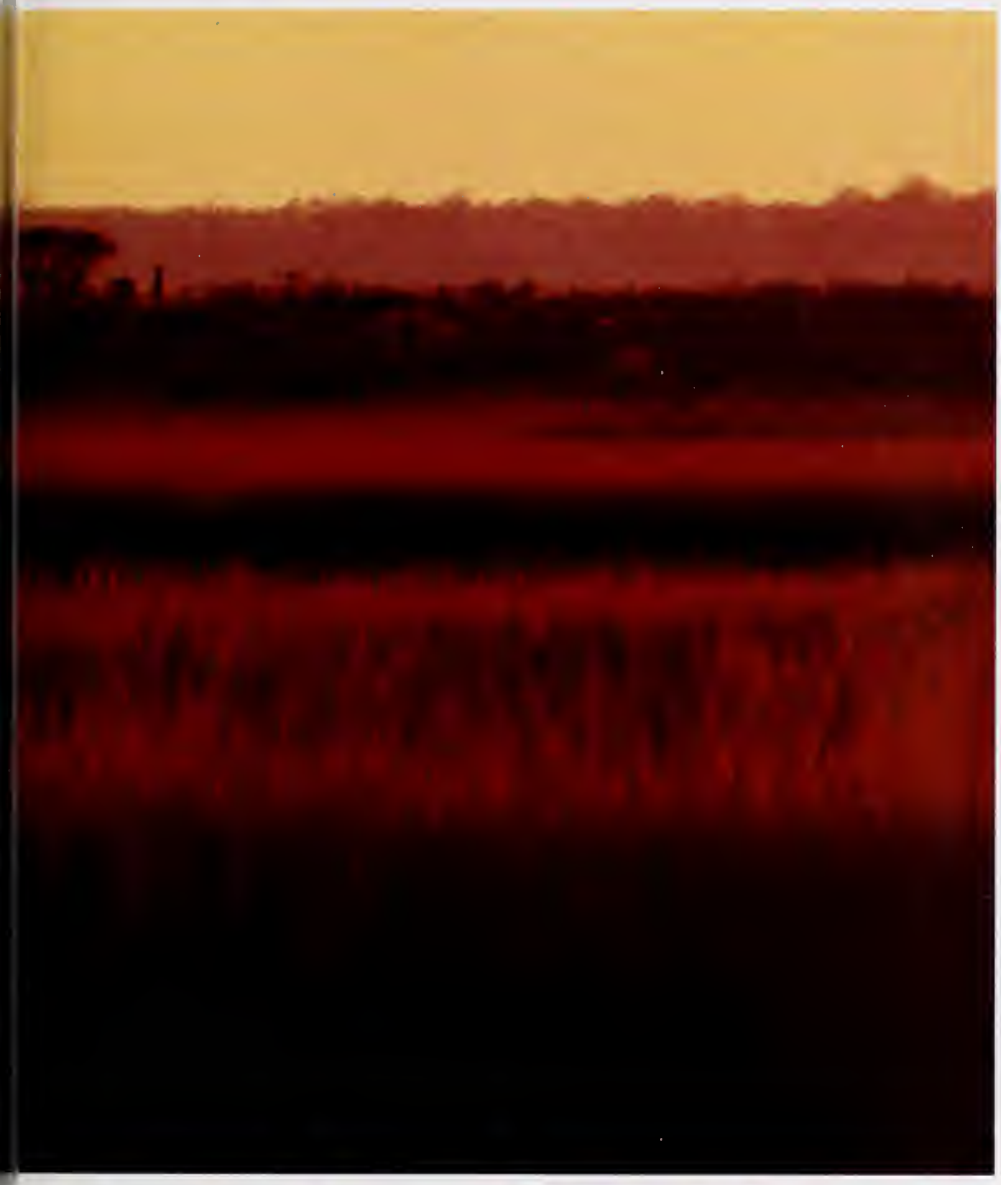
I'm glad you asked.

Were it not for the fact that marsh grass lives, dies, and decomposes, Virginia would have no oyster business, no crab industry, no commercial or saltwater recreational fishing, no rail hunting, and precious little waterfowling in the winter. If you were to list all of the economic and recreational benefits of saltmarshes—commercial fishing, sportfishing, erosion control, water purification, flood control, etc.—all would share a common link: that tough, slender green plant that grows in profusion in all of Virginia's saltmarshes.

The plant is called *Spartina alterniflora*, and it is one of a handful of plants capable of surviving the harsh environment of saltwater and coastal storms. This is the predominant plant of the marsh, this tall, coarse grass that grows tall along the banks of creeks and throughout the wide expanses of saltmarsh that line the Chesapeake Bay and the seaside Eastern Shore. You may have heard it called saltmarsh cordgrass, saltgrass, or simply marsh grass.

Another grass of the marsh is *Spartina patens*, a fine, small grass called saltmeadow hay which grows in cowlicks on the higher marsh. Also in the high marsh are plants such as *Distichlis spicata*, which resembles patens; marsh elder; sea lavender; and thick-bodied salicornia, which in the fall looks like a miniature neon tube. All of these plants help the marsh perform its function, but none is as prolifiic or as important as *Spartina alterniflora*.

Consider a small pond tucked away in a coastal marsh. Along its edges grows *Spartina alterniflora*. In the summer the grass is lush and green, using and storing the sun's energy. Periwinkle snails crawl along the green shafts and



A saltmarsh is an unheralded energy factory, cycling nutrients and providing life and habitat for an astonishing number of species. Perwinkle snails and fiddler crabs are just two species caught up in this fine-tuned system of life and death.

fiddler crabs search for bits of food among the bases of the plants. Willets and rails have nests in the thick, high growths. Even to the casual observer, the marsh is alive in summer.

But in the fall the grass begins to wither. By early winter the shafts are brown and brittle, and the winter storms eventually break them, or they are sheared off by the sharp edges of ice. By the end of February the marsh looks decimated. Only the weathered remnants of the lush grass remain, and they lie decomposing in the shallow pond.

And then something very important happens. The broken blades of old spartina that fell and drifted into the pond are attacked by bacteria, which digest the leaves and break them up into smaller pieces. As the grasses decompose, the small particles and the bacteria which feed on them are spread through the marsh by the tides. Algae is added to this mix to produce a nutrient-rich soup called detritus, the most abundant food in the marsh. The detritus mixture touches nearly every animal that comes in touch with the saltmarsh, including man.

In spring, when the tiny protozoa and marine worms of the pond are brought to life by the warming rays of the sun, they will feed on detritus, as will the larvae of many marsh insects such as mosquitos and flies. Fiddler crabs eat detritus also, scooping it up with their tiny claws. Small fish that live in the pond—killifish and mummichogs—filter detritus from the water, as do oysters and clams, which burrow beneath the muddy bottom of the pond and send up a funnel-like membrane to suck in bits and pieces of food suspended in water.

With detritus, the food chain of the saltmarsh begins. It feeds the smallest animals, which are in turn consumed by larger ones. Minnows are eaten by flounder, and the flounder is eaten by an osprey, or by a human fisherman. Grasshoppers feed on living spartina, and wrens, sparrows, and red-winged blackbirds come to the marsh for the grasshoppers.

The saltmarsh pond harbors a great variety of life, most of which depends directly upon the spartina/detritus cycle for existence. Microscopic animals and

marine worms burrow into the detritus-laden silt on the pond's bottom. Clams, mussels, oysters, blue crabs, fiddlers, periwinkles, and diamondback terrapins might be full-time residents. Rails, gulls, terns, herons, oystercatchers, and egrets prowl the shallows, searching for small crustaceans and insects. In winter the pond is a favorite of the black duck and other dabbling ducks. Snow geese will feed on the tubers and stems of the spartina, unwittingly enlarging the pond's boundaries by their appetite for the salty roots.

The saltmarshes are vital to nearly all of the commercially valuable fish and shellfish caught in Virginia. Some fish, such as menhaden and mullet, live as adults in the open water, but come into the shallow, protected waters to mature. Weakfish come to the estuaries to spawn, although the adults may travel many miles up and down the coast. Anadromous fish, such as the striped bass, will pass through the estuaries on their way to freshwater areas to spawn. Only tuna, haddock, yellowtail flounder and ocean perch, among the 12 most commercially valuable fish in the United States, are not associated with the estuarine waters.

An experiment conducted by John and Mildred Teal at Bears Bluff Laboratory in South Carolina has shown that marsh ponds can produce 250-400 pounds of fish per acre per year, 100 pounds of crabs, and from 300 to 400 pounds of shrimp. This harvest was made without the use of cultivation, with the exception of predator control for shrimp.

The question that remains to be answered is why, if saltmarshes are so productive, are they still being drained, filled, polluted with human and industrial wastes, and otherwise despoiled?

There is no easy answer, although environmentalists are quick to point a collective finger at developers whose condominiums and golf courses have supplanted wetlands in many coastal areas of the United States. Still, there must be a market in order for the condo builders to justify their draining and filling, so the consumer is certainly no less worthy of blame. The prevailing attitude, even among those sensitive to the plight of wetlands, is that just a few more square feet won't hurt, especially if it means I can get a nice view from my living room of the sun on the bay.

Spartina alterniflora *is the root of all energy in the saltmarsh ecosystem—though in the winter, it may look desolate indeed. Above: A great egret stalks a saltmarsh shallows. Below: A mollusk lies hidden in tidal muck.*

Saving the wetlands is a fairly recent environmental issue. For centuries, wetlands were considered wasteland, a nuisance to be avoided or eliminated on the way to a bigger and better America. During the Depression, government make-work jobs included the ditching and draining of thousands of acres of tidal wetlands. Coastal resorts were built by legions of dumptrucks, which scurried like an army of ants from mainland to marshland with countless loads of fill dirt and top soil. Less than 20 years ago saltmarshes in Virginia were being destroyed to the tune of as much as 500 acres per year. Many people simply were not aware of the overwhelming importance of wetlands. And in many places, the dumptrucks are still on the move.

The value of a saltmarsh is difficult to express in terms understandable to those who deal regularly with profit and loss statements and depreciation tables. There is no mathmatical formula, no handy equation, no fixed percentage of return or profit margin. However, now it is generally understood that if we are to have a commercial fishing and shellfishing industry, and if we are to continue to attract tourists who will spend money to catch fish and look at birds, we must retain our wetlands and insure their good health.

The question, then, becomes how much is enough? Although we are no longer losing our wetlands in great chunks, they are still being "reclaimed" by the half-acre and acre, again with the benevolent assumption that "just this little bit won't hurt." To paraphrase T.S. Eliot: this is the way the world ends—not with a gobble, but a nibble.

Neither is there universal agreement among those who make and enforce our wetlands laws that marshes are indeed worthy of preservation. This spring on the Eastern Shore, a developer sold lots and planned a major second home development on one of the few remaining unspoiled barrier islands on the East Coast. Unstable as it is for permanent development, and vital as it is in its pristine state to the integrity of the saltmarsh ecosystem, development will probably commence with permits issued on a site by site basis. The nibbling continues.

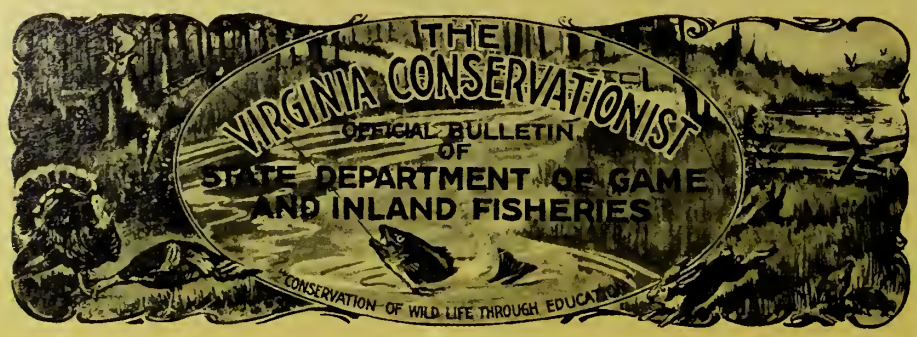
The value of a saltmarsh is not immediate and tangible like that of a condominium or fast food restaurant. Neither does a saltmarsh offer the visual excitement of, let's say, the Grand Canyon. We probably won't attract two million tourists with their Winnebagos and Nikons who will drive across country for a reverent look and a few snapshots of a marsh. If we could, we'd have legions of motel owners and restaurant operators joining the ranks of militant environmentalists.

The saltmarsh is beautiful in a subtle way, and if I were forced to decide whether to spend the remainder of my life near the Grand Canyon or the saltmarsh, I would quickly choose the later. A canyon is a violent place, full of rocks and ridges and jagged lines. A marsh is flowing and graceful, and it is lush with life. May it forever remain so. □

Curtis J. Badger is director of publications for the Wildfowl Art Museum of the Ward Foundation in Maryland and a frequent contributor to Virginia Wildlife.

July Journal

Editor's note: Upon reaching the respectable age of 70, the privilege of age allows us to reminisce a bit. Thus, each month through the end of the year, we will call up some words from our past. This month's is excerpted from Vol. 1 No. 4, April 1921.



Stream Pollution In Virginia

by R.T. Corbell, Field Secretary, Department of Game & Inland Fisheries

One of the most important problems today confronting conservationists in Virginia is the matter of the pollution of the watercourses of the State by industrial plants located along their banks. Some of the finest streams in the State have been defiled to such an extent that they are now destitute of fish. In some of the fresh water streams above tidewater the pollution is so great as to make the water unfit for stock to drink.

There is also considerable pollution of the tidal waters of the State. In that section it has been found that the discharge of bilge water from tank steamers coming inside the Capes is injuring the great oyster beds of the waters tributary to the Chesapeake Bay. The State Fish Commission has taken steps to correct the practice, and has successfully prosectuted masters of ships who used Hampton Roads and adjacent waters as a dumping ground for bilge and other refuse. It is with the inland waters of the State, however, that the Department of Game and Inland Fisheries is especially concerned, and the situation in the tidal waters of the State is merely cited to show that pollution of our watercourses generally represents a distinct economic loss to the Commonwealth.

A recent survey conducted by the Department showed no less than 25 streams above tidewater polluted to such an extent that fish therein have been killed outright or driven away. Powell's river, the Shenandoah, the James, near its headwaters, and the North river are illustrations. The Shenandoah, once one of the finest bass streams in the State, is now in places a murky run, and barren of fish. It is the same with the North river. Actual tests made in this river, as it passes through Rockbridge county, showed that the waters contaminated with refuse from a paper mill and tannery killed the fish outright. Similar conditions exist in the James river, above Lynchburg. The waters of Powell's river, at points in Wise county, are of the color of ink, caused by pollution from tanneries and extract plants.

Careful investigation by the Department disclosed the fact that the pollution of the twenty-five streams consists of the refuse from tannery vats, silk mills, saw mills, alkali works, magnanese mines, coal mines, pulp and paper mills, planing mills, tannic acid plants and extract plants. Five of the streams are defiled by the refuse from saw mills, six by the refuse from tanneries and three from the waste of extract plants. And this pollution is growing apace, with a public apparently apathetic in checking its spread. Valuable fish are being destroyed in this manner by the tens of thousands, and in some instances lands of farmers that, after heavy rains, are overflowed by polluted streams, have been rendered unfit for agricultural puposes. In some instances the streams have become nothing more than sewerage systems for manufacturing plants. Sooner or later, the fish in the inland waters of the State are going to become extinct unless some sort of regulation is devised by which they may continue to live under the development of industry which is now destroying them. The time to consider measures to prohibit all manner of pollution is now.

The situation, especially with reference to some of the streams in the mountainous sections, is serious enough to invite the careful study of those citizens who would preserve our fish life from extinction and our beautiful streams for the people of the State in their character as sovereign in trust and for public uses only.

Our present laws are inadequate to deal with the situation. New statutes are needed. Other States have the same problem, and Pennsylvania appears to have solved it more satisfactorily than any other. The law of that State requires manufacturing plants located near watercourse to erect tanks or other suitable receptacles to take care of their refuse so that it may not pass into any stream in the State. The penalty for a violation of this provision is a fine of not less than $50 for each offense, in addition to liability for all damages done to owners or lessees on the watercourse. The Federal government has gone even further in efforts to prevent the pollution of water over which it has jurisdiction by prohibiting any manufacturing plant from discharging into any navigable stream refuse of any description, whether injurious to fish life or not.

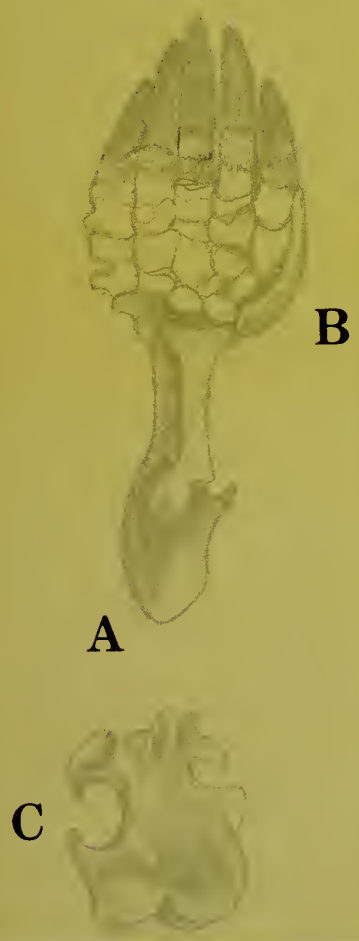
The fish in the inland waters of the State are just as much a natural resource and asset as are the oyster beds of tide-

water. These fish belong to the people of the State, and any who undertakes to destroy them does the State a very great injury. Under existing conditions some of our streams are in a fair way to be utterly ruined by pollution. The pollution is increasing every year, and the time has come for the manufacturer and the State to sit down together and talk things over.

The matter is one to which the General Assembly of 1922 should give serious consideration. □

We Got Our Bones Mixed Up!

In the May issue of *Virginia Wildlife*, we improperly labeled a mole's bones on page 22. Below is the corrected version—so sorry Mr. Mole!



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V·I·R·G·I·N·I·A'·S

The Meadow Vole

by John F. Pagels
photo by Nell Bolen

W·I·L·D·L·I·F·E

The sounds of spring in the overgrown field had been interrupted only by quiet chatter—mine and that of the landowner, along to find out what those voles were that I was trying to collect.

We had seen a couple of brown blurs scurrying along, but the first live traps were empty except for the dab of peanut butter and the bite of potato needed for bait. The landowner made it a point to assure me that he thought I'd have better luck trapping at his house in town. Finally, trap six contained a young meadow vole—to me a good first sign about the status of the population.

When the landowner saw the vole, he did himself proud, exclaiming that this little ball of fur with a short tail didn't look at all like his mice. I explained that the long tails of house mice, and for example, deer mice, were used for balance in their climbing activities. Voles, sometimes called field mice, are basically restricted to surface runways and a long tail would do little more than serve as a handle for predators and a radiator to lose body heat—especially when it was dragged through wet vegetation or puddles in cold weather.

We discussed the vole's coloration too. It's not like that of climbing species of mice that move in areas where moonlight or sunlight can reach them. Climbers such as deer mice are often highly bicolored, a trait which breaks up their body outlines and assists in camouflage. But a white belly and feet on a vole would make it all the more obvious to predators as it scurries along its runways. Thus, its color is dull and relatively uniform.

As I placed a tag on the vole's ear, I told how the size of the ear, too, was related to where it lived, and that the small ear was the basis for its generic name; micro means small and otus means ear area, thus *Microtus*. The species name has to do with where it was described, hence, *Microtus pennsylvanicus*.

Upon release, the tagged vole ran about three feet and disappeared into a hole. "So that's where they spend most of their time!" said the landowner. Well, not really. Meadow voles do use burrows sometimes, especially in winter if well-drained soils are available, but they're best known for above ground nests made up primarily of grasses which also make up a good portion of their diet.

Later, when we got to a marshy spot down by the pond, I showed him an old nest in a bunch of grass. Meadow voles are found throughout the Commonwealth and are often abundant in moist situations, including brackish marshes, but they'd need snorkels to spend time in underground burrows there.

The next couple of catches included an adult male and a large female—a very large female. Actually, the female was pregnant. Newborn voles, as with many small rodents, are pinkies at birth, and the litters are usually large, often five or six, and up to a dozen. It felt like this one contained about nine fetuses.

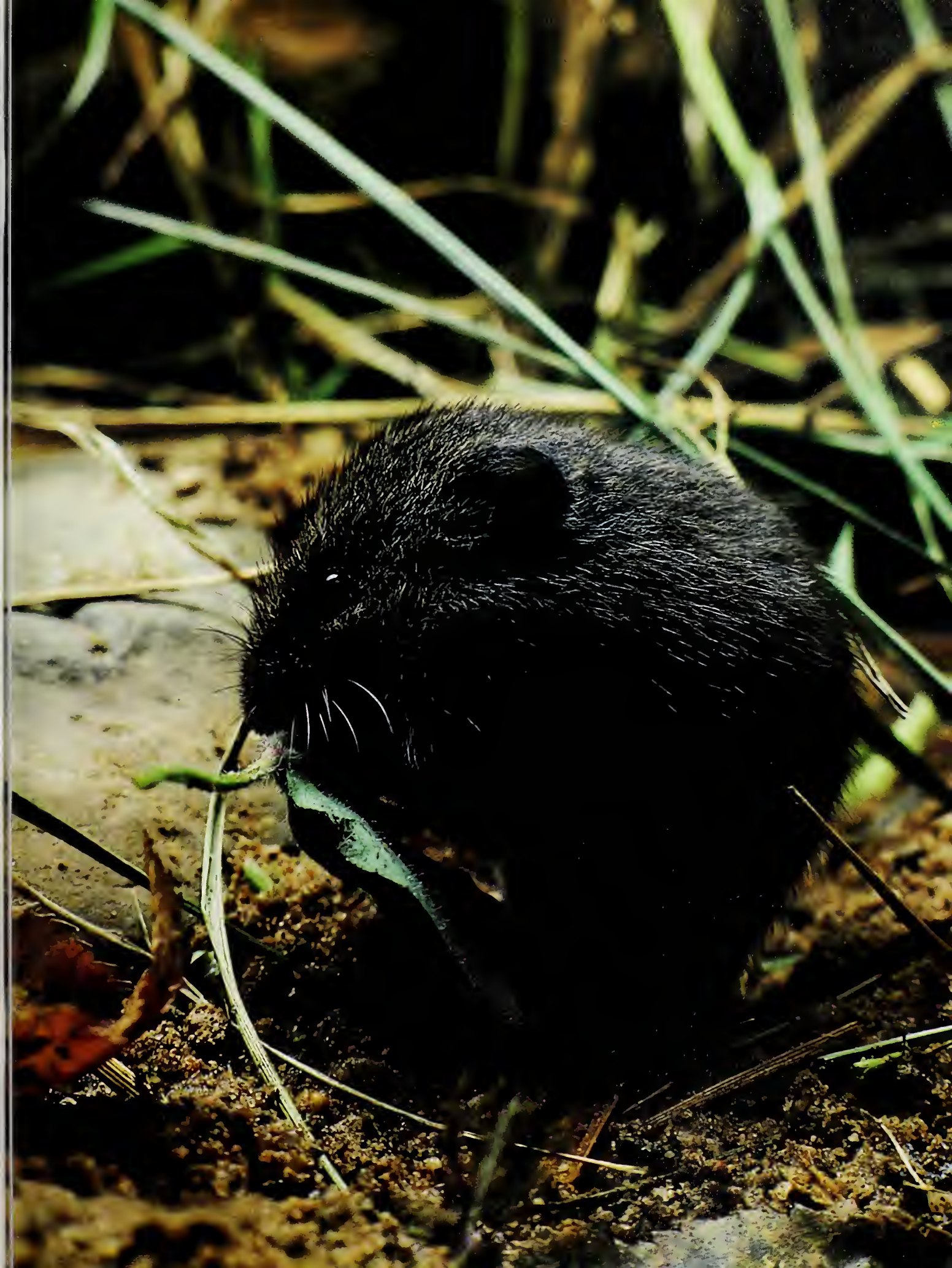
Meadow voles have a very high reproductive potential. This one would probably have its litter in a day or two, and the females born then would be sexually mature in 20 days. In about 25 days after that, they would be having their own young! A 45-day-old mother! Sounds like they could take over the earth! Well, fortunately, they won't. Active both night and day, the meadow vole is one of our most important prey animals—a mainstay of the diets of many hawks, owls, snakes, and a lot of mammalian predators, too. Only about 15 percent of the young live to be 30 days old and a meadow vole in the wild that's more than one year old is considered ancient.

Plus, vole populations are cyclic with peaks about every four or five years. Near the beginning of a population crash, their runways in fields would be abundant and easily spotted. Quality food and shelter sites probably would be lacking, predator populations would be high, and well, in a sense, the animals generally would be stressed to the point that they could be considered behavioral and physiological wrecks.

Right now what we were seeing in this old field was just the opposite. A healthy field—a healthy growing vole population. Ah, Doc—what you're trying to say is that right now we're standing in the middle of a field where density dependent mortality is low, thereby resulting in the exponential or rapid growth phase of this population.

That's easy for you to say! □

John F. Pagels is a mammalogist at Virginia Commonwealth University.



Does our fishing scene on the James River look good to you? Then you won't want to miss all the exciting art and photography on the inside of the new 1986-87 Virginia Wildlife Sportsman's Calendar.

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